

Space Radiation Effects in Inflatable and Composite Habitat Materials

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HAT: 6.5.a, 6.6.b, 12.1.a, 12.1.b TA: 6.5.1, 6.5.2, 6.5.3, 12.2.1, 12.3.2 TRL: NA (provides material qualification data)

OVERVIEW

This Year 2 project provides much needed risk reduction data to assess solar particle event (SPE) and galactic cosmic ray (GCR) space radiation damage in existing and emerging materials used in manned low-earth orbit, lunar, interplanetary, and Martian surface missions. More specifically, long duration (up to 50 years) space radiation damage is quantified for materials used in inflatable structures (1st priority), and habitable composite structures and space suits materials (2nd priority). The data collected has relevance for nonmetallic materials (polymers and composites) used in NASA missions where long duration reliability is needed in continuous or intermittent radiation fluxes.

INNOVATION

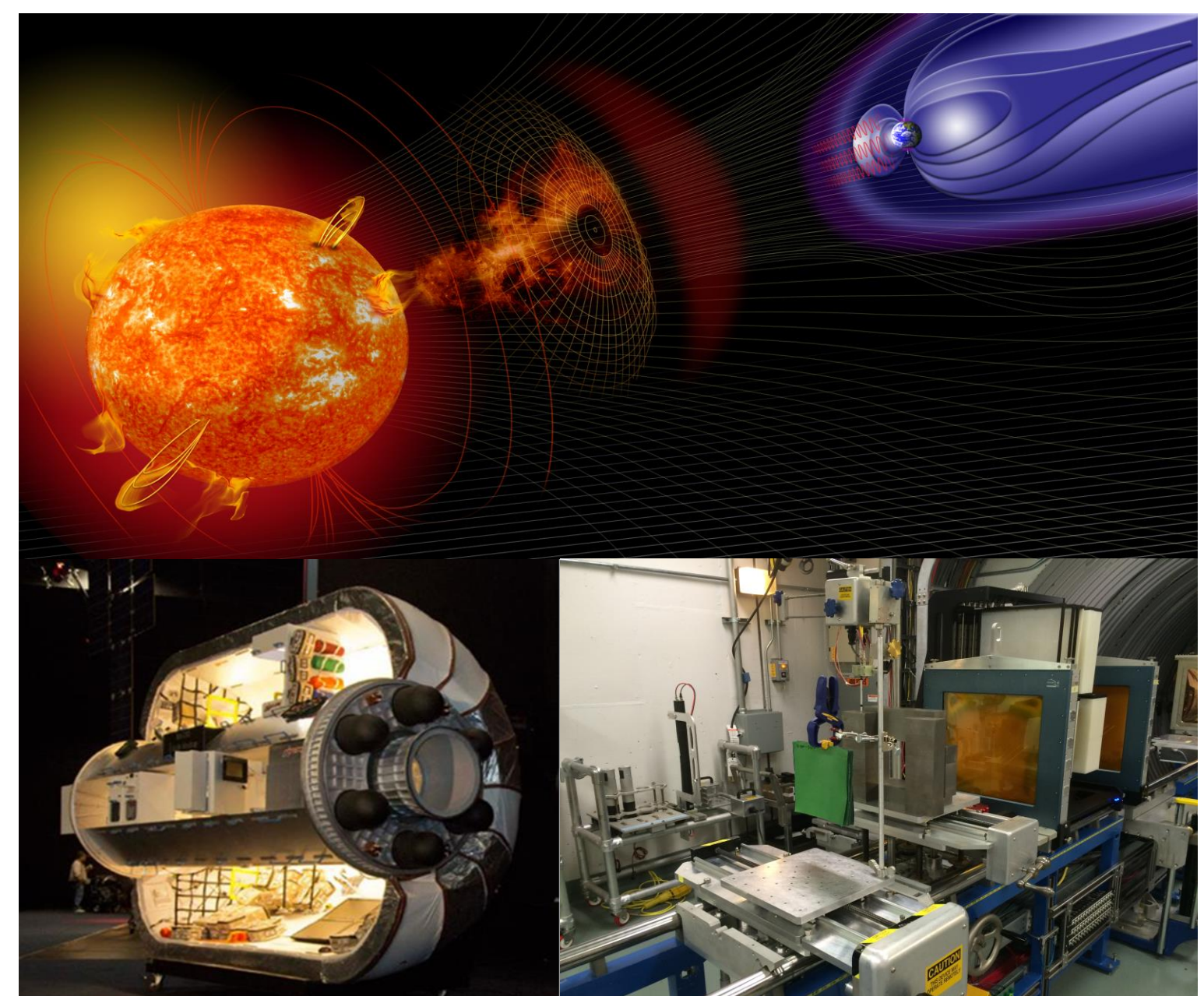
HAT 6.5 and 6.6 evaluate human effects, but not long-term GCR and SPE effects in nonmetallic materials. This project fills this gap, providing conclusive data to establish permissible exposure limits and projected service lifetimes for the material classes studied. This ensures that in addition to weight/cost savings, these materials will be stable after long-term space radiation exposure. Poorly understood nonionizing displacement effects due to GCR exposure are also investigated.

OUTCOME

- NASA methodology for certification of nonmetallic materials used in space radiation environment.
- Promote accelerated use of lightweight spacecraft materials technologies.

INFUSION SPACE / EARTH

- This proposal has relevance for nonmetallic materials, e.g., inflatable activity modules, Z-series space suits, composite crew module, composite habitat, Orion composites, International Space Station pressure vessels, and future projects improving radiation resistance and shielding.



Exposure of inflatable activity module materials-of-construction with particle radiation representing a long-term SPE and GCR space radiation exposure.

PARTNERSHIPS / COLLABORATIONS

This project partners with radiation experts at JSC, JPL, MSFC, Brookhaven National Laboratory NASA Space Radiation Laboratory (BNL NSRL), Los Alamos National Laboratory (LANL) and the TRI University Meson Facility (TRIUMF).

PAPERS / PRESENTATIONS

A NASA Investigative Report is being completed for Year 1 results including recommendations for long term durability of inflatable and space suit materials in their respective space radiation environments. Findings will also be incorporated into NASA-HDBK-6015 or a new NASA standard methodology for certification of nonmetallic materials for space radiation environments.

FUTURE WORK

Available 30-180 MeV proton radiation sources capable of simulating SPE radiation exposures will be screened and vetted to shore up previous capability available at the Indiana University Cyclotron Facility (IUCF) that was lost in 2014. The intention is to augment and extend NASA's radiation exposure capabilities while ensuring the capabilities available are both cost effective and representative of the space radiation environment.

